with U.S. syntax and to eliminate the inadvertent inconsistency between claim 1 and the specification and drawing.

Claim 1 as filed described the second electrode 3 as triggering the resonator in a second drive direction. However, Fig. 1 clearly shows that the electrodes 2 and 3 are conductively connected directly to each other at switch terminal 8c, and the electrodes 4 and 5 are conductively connected directly to each other at switch terminal 8b. This is described structurally at line 33 of page 3 through line 3 of page 4. One of ordinary skill knows that in a bimodal resonator as shown in Fig. 1, electrodes 2 and 3 will trigger one drive direction, and the electrodes 4 and 5 will trigger the other direction.

Further, the drive function is described with the correct reference identifications at line 26 of page 4 through line 2 of page 5.

Accordingly, in claim 1 "(3)" has been changed to "(4)" and "second electrode" has been changed to "other electrode."

With respect to claim 2, applicants point out that "designed to" is language found at lines 3-6 on page 2 of the instant specification as filed. Those of ordinary skill will recognize that the symmetrical arrangement of four rectangular electrodes may not provide good feedback signals with some configurations of the piezoelectric element and its mounting. In those situations the electrode shapes may be modified from the typical rectangle to improve the usefulness of the feedback signal without serious reduction of the driving efficiency.

Claims 11-20 are added to cover an aspect of the invention believed deserving of specific coverage. Providing the control signals "alternatively" means that there is no time that the control signals are being provided simultaneously to both the first and the other control electrodes. This function is inherent in the circuit of Fig. 1. With respect to claim 11 language, applicants point out that "alternate utilization" at line 6 of page 6 is sufficient support for the use of "alternative" in the claims.

Art rejection - US 5,949,177 (hereinafter "O'Brien") and US 5,777,423 (Zumeris)

To the extent that the rejection over O'Brien or Zumeris might be maintained against the amended and added claims, reconsideration is requested because neither patent teaches nor at all suggests a feedback from a non-energized other electrode associated with drive in a second drive

direction while a first electrode is being triggered to drive in a first drive direction. Nothing in Paper No. 7 alleges a feedback from one electrode to a regulating circuit at the time that a different electrode is being triggered.

O'Brien Figs. 1A - 1E clearly show diagonal cross-connection of the electrodes like that shown in instant Fig. 1. The circuit of Fig. 3 clearly shows that the only connection to the 4 electrodes is through switch SW1, which can carry signals to only one pair of electrodes at a time. The controller output V_D is used to provide buffered signals V_1 and V_2. A velocity feedback circuit 40 compares the signal V_1 which includes the effect of the back EMF in the electrified electrode to the modified signal V_2 (col. 2, line 64 through col. 3, line 30).

Fig. 5 of Zumeris shows clearly that the modulators 58-64 provide drive signals to the electrodes in the directions shown by arrows on the signal lines. There is no suggestion of a feedback from non-driven electrodes. Element 66 is a "tuning inductor" which has nothing to do with feedback.

In describing variations of the embodiments of Figs. 3 and 4 (col. 11, line 60 et seq; especially col. 12, lines 30-39), Zumeris states that the non-electrified electrodes are either grounded or allowed to float.

Thus O'Brien and Zumeris each teach that there is no electrical connection from the electrodes which are not being driven at a given time, to the control or regulator circuitry. This teaches away from use of these non-energized electrodes for a feedback signal.

Accordingly claims 1-8 and 11-20 are neither anticipated by nor suggested by the applied patents.

Art rejection - O'Brien or Zumeris, and US 6,121,717 (hereinafter "Diefenbach)"

To the extent that the rejection over O'Brien or Zumeris might be maintained against claim 9 taken with amended claim 1, reconsideration is requested for the reasons given with respect to claims 1, etc., and because nothing in Diefenbach at all suggests the feedback connection claimed.

Like Zumeris, Diefenbach shows only driving connection to the electrodes, and no feedback.

Further cited patents

Applicants note the citation of Suganuma and Atsuta as teaching use of one piezo element as both a drive and feedback element. Applicants believe that one of ordinary skill would not call the piezo elements both drive and feedback elements. Rather each piezo element is used for driving, and the feedback elements are the circuits, connections and elements which feed back signals related to the voltage applied to, and current flowing into, the piezo element.

In the Atsuta Fig. 1 embodiment, the rectifier circuits 12 and 13 provide a signal which is the absolute value of the voltage across the respective piezo elements A and B. Each of these elements appears to be continuously excited when the motor is operating. In the Fig. 6 embodiment, instead of sensing respective voltages applied to the elements, current sensors 15, 16 provide a signal corresponding to the current flowing into the element.

Suganuma teaches that the difference between the drive voltage and the drive current for a triggered drive element is used to provide a phase shift signal which is input to a regulating and driving circuit.. This, like Atsuta, is quite different from, and not suggestive of, sensing a voltage on a temporarily non-driven electrode, and feeding this back to control the field applied to another electrode which is being driven.

CONCLUSION

All formal matters are complied with, and the claims are shown to be patentable over the applied art.

Early favorable action on the application is requested.

Respectfully submitted,

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MARKED-UP CLAIMS

1.(amended) A piezoelectric drive device [with] comprising a bimodal piezoelectric resonator (1) and means for supplying control signals (S),

[with] wherein said resonator (1) comprises:

at least a first control electrode (2) for triggering the resonator (1) in a first drive direction, and

[with] at least [a second] an other control electrode [(3)] (4) for triggering the resonator in a second drive direction, and

[with] said means for supplying control signals comprises a trigger circuit (6) for supplying control signals [(s)] (S) to the first and the [second] other control electrode, characterized in that:

[-] the device further comprises a regulating circuit (7) [is provided] for regulating the control signals [(s)] (S),

[-] [the second control electrode (3) is designed] first means for supplying a feedback signal (k) from the other control electrode (4) to the regulating circuit (7) when the resonator is not being triggered by said other control electrode and the resonator (1) is being triggered in the first drive direction by means of the first control electrode (2), and

[-] [the first control electrode (2) is designed] second means for supplying a feedback signal (k) from the first control electrode (2) to the regulating circuit (7) when the resonator is not being triggered by said first control electrode and the resonator (1) is being triggered in the second drive direction by means of the [second] other control electrode [(3)] (4).

2.(amended) A piezoelectric drive device as claimed in claim 1, wherein said other control electrode is a third electrode (4), characterized in that

[-] the piezoelectric resonator (1) comprises a first pair of control electrodes (2,3) consisting of said first electrode (2) and a second electrode (3) for triggering the resonator in the first drive direction, and a second pair of control electrodes (4,5) consisting of a third electrode which is said other electrode (4) and a fourth electrode (5) for triggering the resonator in the second drive direction,

[-] the second pair of control electrodes (4,5) is designed for supplying a feedback signal (k) to the regulating circuit (7) when the resonator is not being triggered by said second pair of electrodes and the resonator (1) is being triggered in the first drive direction by the first pair of control electrodes (2,3), and

[-] the first pair of control electrodes (2,3) is designed for supplying a feedback signal (k) to the regulating circuit (7) when the resonator is not being triggered by said first pair of electrodes and the resonator (1) is being triggered in the second drive direction by the second pair of control electrodes (4,5).

4.(amended) A piezoelectric drive device as claimed in claim 1, characterized in that the regulating circuit (7) [is designed for evaluating] evaluates the amplitude of the feedback signal (k).

5.(amended) A piezoelectric drive device as claimed in claim 1, characterized in that the regulating circuit (7) [is designed for evaluating] evaluates the phase difference between the control signal [(s)] (S) and the feedback signal (k) by means of a phase control (PLL) circuit.

6.(amended) A piezoelectric drive device as claimed in claim 1, characterized in that the regulating circuit (7) [is designed for regulating] regulates the frequency of the control signal [(s)] (S).

7.(amended) A piezoelectric drive device as claimed in claim 1, characterized in that the regulating circuit (7) [is designed for regulating] regulates the amplitude of the control signal [(s)} (S).

8.(amended) A piezoelectric drive device as claimed in claim 1, characterized in that the regulating circuit (7) [is designed for regulating] regulates the frequency of the control signal [(s)] (S) in a first step, and [for regulating] regulates the amplitude of the control signal [(s)] (S) in a second step.